

Scope of Work (SOW) for S8.B Status and Trends Monitoring Option #2: Permittee-Conducted Monitoring in Puget Sound

Date: October 23, 2013

Purpose: The purpose of this SOW is to define and describe the monitoring activities and products that will be delivered by permittees to Ecology from September 2013 through August 2018. This document applies only to Phase I Municipal Stormwater NPDES permittees in Puget Sound choosing option S8.B.1.b and Phase II Municipal Stormwater NPDES permittees in Puget Sound choosing S8.B.2 in the 2013-2018 permits.

Questions about this SOW should be directed to [Karen Dinicola](#) at (360) 407-6550.

Table 1. Tasks and Timeline.

Task	Implemented by	Anticipated Timeline
0. Permittee notification to Ecology	Permittees	October 15, 2013 for Phase I, December 1, 2013 for Phase II
1. Puget lowland small streams monitoring and assessment	Permittees	Conduct monitoring in 2014 - 2015*
2.1 Marine nearshore sediment monitoring and assessment	Permittee	Conduct monitoring in summer 2016
2.2 Marine nearshore mussel contaminant monitoring and assessment	Permittee	Conduct monitoring in winter 2015-2016 and winter 2017-2018
2.3 Marine nearshore bacteria monitoring and assessment	Permittee	Conduct monitoring October 2015 through September 2016

* The permits say "Beginning no later than July 31, 2014." The July 2013 published errata correct the date to October 31, 2014.

Task 0. Notification to Ecology: As required by the permits, all Puget Sound permittees shall notify Ecology in writing by October 15 (Phase I) or December 1 (Phase II), 2013, whether they choose: to contribute to a pooled fund to conduct regional status and trends monitoring, or to conduct their own monitoring as detailed in Tasks 1 and 2 below.

Task 1. Status and Trends Monitoring in Small Streams in Puget Sound Lowlands

1. Status and trends monitoring for small streams

A. Prepare to manage data

- i. Create account with King County to store data in Puget Sound Stream Benthos database. See <http://www.pugetsoundstreambenthos.org/>
- ii. Create EIM account for water quality, sediment chemistry, and watershed health data
- iii. Confirm that data management tools are available to handle all data and that all data will be quality controlled, stored and accessible to the public

- B. Confirm sites and prepare for sampling to begin by October 2014
 - i. Use the Ecology-provided Status and Trends Monitoring of Small Streams Quality Assurance Project Plan (QAPP) that is expected to be finalized in early 2014.
 - ii. The sampling site lists, sorted by County, are posted at [Ecology's Regional Stormwater Monitoring Program \(RSMP\) website](#). The County list is a re-organized list of the Master Sample spreadsheet. Permittees will need to select sites within their jurisdictions. The required numbers of sites and the distribution of the sites inside and outside Urban Growth Area boundaries are determined in permit condition S8.B.1.b.i for Phase I permittees and S8.B.2.a for Phase II permittees.
 - iii. Confirm that all sites are accessible and suitable for sampling according to QAPP protocols by May 30, 2014. For each site that is not accessible or is documented according to the QAPP as otherwise unsuitable, the next sequential site on the list of will be assessed for suitability. Proceed down the lists until required number of sites is found.
 - iv. Identify and procure permits necessary for sampling sites
 - v. Procure sample collection equipment necessary to produce data according to the QAPP
 - vi. Procure accredited laboratories for analysis
 - vii. Procure and train staff
- C. Prepare to manage small stream status and trends monitoring data
 - i. Confirm that data management tools are available to handle all data and that all data will be quality controlled, stored and accessible to the public
 - ii. Ensure data quality is evaluated and report all data to the required databases according to the QAPP
- 2. Conduct monitoring according to the approved QAPP. The sampling protocols and procedures detailed in the draft QAPP (Collyard, 2011) are from previously-approved QAPPs and are expected to have only minor changes.
 - A. Collect and report monthly water quality index (WQI) and instantaneous flow monitoring at the required sites for one year, from October 2014 through September 2015.
 - i. WQI Parameters: total phosphorus, total nitrogen, turbidity, total suspended solids, specific conductance, pH, chloride, fecal coliform, temperature, and dissolved oxygen
 - ii. Estimate streamflow following the approved QAPP
 - B. Collect and report annual stream benthos, habitat monitoring, and stream sediment chemistry at the required sites one time, in summer 2015
 - i. Benthos parameters: aquatic macroinvertebrates and periphyton
 - ii. Water quality parameters: chlorophyll a, ammonia, nitrate-nitrite, total suspended solids, percent solids, hardness, total organic carbon, total phosphorus, total nitrogen, chloride, and turbidity
 - iii. Habitat monitoring: slope, bearing, habitat unit presence, side channel, wetted width, bankfull width, bar width, substrate size, substrate depth, shade, human influence, riparian vegetation, large woody debris and grain size estimation

- iv. Sediment chemistry parameters
 - a) Metals: copper, lead, arsenic, and zinc
 - b) PAHs: naphthalene, 2-methylnaphthalene, 1-methylnaphthalene, 2-chloronaphthalene, acenaphthylene, acenaphthene, dibenzofuran, fluorene, anthracene, carbazole, phenanthrene, fluoranthene, pyrene, retene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(ghi)perylene, chrysene, benzo(b)fluoranthene, and benzo(a)anthracene
 - c) Pesticides: 2,4-D, triclopyr, carbaryl, and chlorpyrifos
 - d) Phthalates: Bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, diethyl phthalate, dimethyl phthalate, di-n-butyl phthalate, and di-n-octyl phthalate
 - e) PBDEs: 47, 49, 66, 71, 99, 100, 138, 153, 154, 183, 184, 191, 209
 - f) PCB congeners: all 209 congeners
 - g) Hormone disrupting chemicals: PPCPs (EPA Method 1694, the list in Column B) and hormones and steroids (EPA Method 1698)
- 3. Ensure quality assurance and quality control (QA/QC), data reporting, and data analysis and interpretation are conducted according to the QAPP
 - A. Participate in interlaboratory comparison study that will be described in the final QAPP. No more than three additional replicate samples will be required for this study.
- 4. Enter the results to EIM and/or other appropriate databases
 - A. Enter stream benthos data into King County's stream benthos database,
 - B. Enter habitat and periphyton data into EIM Watershed Health database
- 5. Make recommendations for future status and trends monitoring in the March 31, 2017 annual report

Task 2. Status and Trends Monitoring in Marine Nearshore Areas of Puget Sound

1. Marine sediment chemistry monitoring and assessment

- A. Prepare to manage data
 - i. Create account and enter data into EIM for water quality and sediment chemistry data
- B. Prepare to conduct monitoring in summer 2016
 - i. Use the Ecology-provided Status and Trends Marine Nearshore Sediment QAPP that is expected to be finalized in 2014. The sampling protocols detailed in the draft QAPP (Dutch et al, 2011) are based on previously approved QAPPs and are anticipated to have only minor changes.
 - ii. Confirm sites
 - a) The master list of marine sediment sites is available at [Ecology's RSMP website](#).
 - b) Permittees will identify sites adjacent to their jurisdictions from the list. The required number of sites is determined in permit condition S8.B.1.b.ii for Phase I permittees and S8.B.2.b for Phase II permittees. Permittees will confirm the required number of accessible sites suitable for sampling by January 31, 2016.

- c) For each nearshore sediment sample site that is not accessible or is documented according to the QAPP as otherwise unsuitable, the next sequential site adjacent to your jurisdiction on the list of alternates will be chosen and must be confirmed
 - iii. Identify and procure permits needed for sampling
 - iv. Procure necessary sampling equipment
 - v. Procure accredited laboratories for analysis
 - vi. Procure and train staff
- C. Conduct marine nearshore sediment chemistry sampling in summer 2016 at the selected sites according to the approved QAPP
 - i. Marine sediment chemistry parameters are listed below. Laboratory methods are found in the QAPP for the Puget Sound Assessment and Monitoring Program: Sediment Monitoring Component (Dutch et al, 2009).
 - a) Grainsize and total organic carbon
 - b) Metals and metalloids: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, tin, and zinc.
 - c) LPAHs: 1,6,7-trimethylnaphthalene, 1-methylnaphthalene, 1-methylphenanthrene, 2,6-dimethylnaphthalene, 2-methylnaphthalene, 2-methylphenanthrene, acenaphthene, acenaphthylene, anthracene, biphenyl, dibenzothiophene, fluorene, naphthalene, phenanthrene, and retene
 - d) HPAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(e)pyrene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene, perylene, and pyrene
 - e) Phthalates: bis(2-ethylhexyl) phthalate, butyl benzyl phthalate, diethyl phthalate, dimethyl phthalate, di-n-butyl phthalate, and di-n-octyl phthalate
 - f) PBDEs: 47, 49, 66, 71, 99, 100, 138, 153, 154, 183, 184, 191, 209
 - g) PCB congeners: all 209 congeners
- D. Ensure quality assurance and quality control (QA/QC), data reporting, and data analysis and interpretation are conducted according to the QAPP
 - i. Participate in interlaboratory comparison study that will be described in the final QAPP. No more than two additional replicate samples will be required for this study.
- E. Enter the results to EIM
- F. Make recommendations for future status and trends monitoring in the March 31, 2017 annual report

2. Mussel contamination monitoring and assessment along Puget Sound shoreline

- A. Prepare to manage data
- B. Prepare to conduct monitoring
 - i. Follow the Ecology-provided RSMP Mussel Monitoring QAPP that is expected to be finalized in 2014. The sampling protocols will be based on the previously

approved QAPP for the Mussel Watch Pilot Expansion Study (Lanksbury et al, 2012 (a)) and are anticipated to have only minor changes.

- ii. Select sites
 - a) The list of randomly selected sites for mussel and bacteria sampling is available at [Ecology's RSMP website](#).
 - b) Permittees will select sites adjacent to their jurisdictions. The required number of sites is determined in permit condition S8.B.1.b.ii for Phase I permittees and S8.B.2.b for Phase II permittees. Permittees will confirm the required number of accessible sites suitable for sampling by June 30, 2015.
 - c) For each randomly selected UGA shoreline site that is not accessible or is documented according to the QAPP as otherwise unsuitable, the next sequential site adjacent to your jurisdiction on the list of alternates will be chosen and must be confirmed
 - d) Permittees will obtain property owner permissions needed to access each site and place a monitoring cage there
- iii. Identify and procure permits needed for sampling; the list of required permits will be available in the QAPP
- iv. Procure necessary sampling equipment
 - a) Refer to specifications and sources for equipment in the QAPP; Permittees may have the option to purchase equipment in a pool with the RSMP
 - b) WDFW will provide the sole source of mussels for this sampling and permittees must come to the aquaculture facility on the date and time specified by WDFW to obtain the mussels
- v. Procure and train staff and volunteers to conduct required field work
- C. Conduct two rounds of mussel tissue sampling at the required sites in winter 2015-2016 and 2017-2018 according to the protocols detailed in Lanksbury et al, 2012 (a and b). Additional relevant laboratory methods are described in Sloan et al, 2004. Permittees may have the option to contract for biotic measurements and laboratory analyses either in a pool with the RSMP or directly from WDFW. Permittees will:
 - i. Come to the aquaculture facility at the date and time specified by WDFW and take possession of prepared mussels for monitoring
 - ii. Deploy cages with prepared mussels at monitoring sites on the same evening they were received from the aquaculture facility; perform field measurements and fill out deployment datasheet
 - a) Mussel habitat measurement parameters include: water temperature, salinity, station location, distance between sub-stations at each site, tidal cycle, and height above waterline
 - iii. Retrieve cages from monitoring sites several months later at the date and time specified by WDFW; perform field measurements and fill out retrieval datasheet
 - iv. The morning following retrieval determine biometrics for a subset of mussels from each monitoring site. Mussel biometrics: percent mortality, condition index.
 - v. Process a subset of mussels from each monitoring site into a composite for chemical analysis according to the QAPP. Mussel chemistry analysis parameters:

- a) PAHs:
 - a. LPAHs: naphthalene, fluorene, acenaphthylene, acenaphthene, anthracene, dibenzothiophene, phenanthrene, and retene
 - b. HPAHs: dibenzoanthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[e]perylene, benzo[a]pyrene, benzo[z]pyrene, chrysene, fluoranthene, indeno-pyrene, perylene, and pyrene
 - c. Substituted PAHs: dibenzothiophenes(C1-,C2-,C3-), fluorenes((C1-,C2-,C3-), naphthalenes(C1-,C2-,C3-,C4-), phenanthrenes+anthracene(C1-,C2-,C3-,C4-), chrysenes (C1-,C2-,C3-,C4-), and fluoranthene/pyrene (C1-,C2-,C3-,C4-)
- b) Chlorinated pesticides: 2,4'-DDD, 2,4'-DDE, 2,4'-DDT, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, alpha-chlordane, trans-chlordane (gamma), trans-nonachlor, cis-nonachlor, nonachlor III, heptachlor, heptachlor epoxide, oxychlordane, alpha-hexachlorohexane, beta-hexachlorocyclohexane, delta-hexachlorocyclohexane, hexachlorobenzene, aldrin, dieldrin, mirex, and endosulfan I
- c) Metals: arsenic, cadmium, copper, lead, mercury, and zinc
- d) PBDEs: 28, 47, 49, 66, 85, 99, 100, 153, 154, 155, 183
- e) PCB congeners: 17, 18, 28, 31, 33, 44, 49, 52, 66, 70, 74, 82, 87, 95, 99, 101, 105, 110, 118, 128, 138, 149, 151, 153, 156, 158, 170, 171, 177, 180, 183, 187, 191, 194, 195, 199, 205, 206, 208, 209
- f) Conventional: total lipids, total solids, δ^{15} nitrogen, and δ^{13} carbon
- D. Ensure quality assurance and quality control (QA/QC), data reporting, and data analysis and interpretation are conducted according to the QAPP
 - i. Participate in interlaboratory comparison study that will be described in the final QAPP. No more than two additional replicate samples will be required for this study.
- E. Enter the results to appropriate state and federal databases
 - i. Deployment and retrieval field data and laboratory biometrics data to Excel; deliver, with paper copies of completed field forms, to WDFW
 - ii. Chemistry data to EIM database
- F. Make recommendations for future status and trends monitoring in the March 31, 2017 annual report

3. Bacteria sampling and assessment

- A. Prepare to manage data
- B. Prepare to conduct monitoring
 - i. The QAPP for this monitoring is expected to be finalized in 2014. It will be based on the approach used for WDOH fecal coliform pollution in shellfish monitoring (Woolrich, 2012); permittees will follow the field sampling and laboratory methods in Appendix A.
 - a) Sites identified and confirmed for mussel contamination monitoring will be sampled for bacteria, if suitable

- b) Develop sampling schedule to facilitate sampling, laboratory and troubleshoot logistics
 - c) Verify sites are suitable and for access during potentially dark hours
 - ii. Use accredited laboratory and procure necessary sampling equipment
- C. Conduct and coordinate monthly bacteria sampling from October 2015 to September 2016 according to the approved QAPP at the required sites
 - i. Parameters: fecal coliform by multiple tube fermentation using EC broth
- D. Interpret and report the results as specified in the QAPP
- E. Ensure quality assurance and quality control (QA/QC), data reporting, and data analysis and interpretation are conducted according to the approved QAPP
- F. Enter the results to EIM and notify Ecology's BEACH Program of known water quality violations
- G. Make recommendations for future status and trends monitoring in the March 31, 2017 annual report

References

All references listed below will be posted at [Ecology's RSMP website](#).

Collyard, 2011. 2012 Status and Trends Stormwater Monitoring and Assessment Strategy for Small Streams. An Addendum to Quality Assurance Monitoring Plan for Status and Trends Monitoring for Watershed Health and Salmon Recovery. Available online at

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/rsmpdocs/smallstream102011.pdf>

Dutch et al, 2009. Quality Assurance Project Plan for the Puget Sound Assessment and Monitoring Program: Sediment Monitoring Component. Ecology Publication No. 09-03-121. Available online at

<https://fortress.wa.gov/ecy/publications/publications/0903121.pdf>

Dutch et al, 2011. Nearshore Sediment Monitoring Addendum to the Quality Assurance Project Plan for the Puget Sound Assessment and Monitoring Program: Sediment Monitoring Component, December 2011. Available online at

<http://www.ecy.wa.gov/programs/wq/stormwater/municipal/rsmpdocs/nearshore.pdf>

Lanksbury et al, 2012 (a). Quality Assurance Project Plan for the Mussel Watch Pilot Expansion Project. WDFW Contract No. 11-1916. Available online at

http://www.ecy.wa.gov/programs/wq/psmonitoring/ps_monitoring_docs/MusselWatchPilotExpansionStudyQAPPFINAL101912.pdf

Lanksbury et al, 2012 (b). Washington State Mussel Watch Pilot Expansion Deployment and Retrieval Protocol. Washington Dept. of Fish and Wildlife. Available online at

http://www.ecy.wa.gov/programs/wq/psmonitoring/ps_monitoring_docs/MusselWatchPilotExpansionProtocol102012.pdf

Sloan et al, 2004. Extraction, cleanup, and gas chromatography/mass spectrometry analysis of sediments and tissues for organic contaminants. NOAA Tech. Memo NMFS-NWFSC-59. Available online at http://www.nwfsc.noaa.gov/assets/25/4330_06162004_125308_eapdetailedproctm59-final.pdf

Woolrich, 2012. Status and Trends in Fecal Coliform Pollution in Shellfish Growing Areas of Puget Sound: Year 2011. Washington Dept. of Health DOH 332-120. Available online at

<http://www.doh.wa.gov/Portals/1/Documents/4400/332-120-PugetSound-statrend-11.pdf>